BONNEVILLE POWER ADMINISTRATION

Habitat Evaluation Procedures (HEP) Report

Vancouver Lowlands Shillapoo Wildlife Area

Technical Report 1994 - 1995 January 1995 DOE/BP-50446-1

This Document should be cited as follows:

Calkins, Brian, Eric Anderson, Paul Ashley, "Habitat Evaluation Procedures (HEP) Report; Vancouver Lowlands Shillapoo Wildlife Area", 1994-1995 Technical Report, Project No. 199204900 (et al.), 50 electronic pages, (BPA Report DOE/BP-50446-1)

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P.O. Box 3621
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This report was funded by the Bonneville Power Administration (BPA), U.S. Department of Energy, as part of BPA's program to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. The views in this report are the author's and do not necessarily represent the views of BPA.

VANCOUVER LOWLANDS BASELINE HABITAT EVALUATION

PROJECT REPORT

PREPARED FOR:
THE BONNEVILLE POWER ADMINISTRATION
Project Number 1992-049-00
Contract Number 92BI-50446

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JANUARY 1995

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VANCOUVER LOWLANDS
BASELINE HABITAT EVALUATION
PROJECT REPORT

INTRODUCTION:

This project was conducted as part of a comprehensive planning effort for the Vancouver Lowlands project area. The study was funded by The Bonneville Power Administration (BPA) and carried out by the Washington Department of Fish and Wildlife (WDFW).

The Vancouver Lowlands is considered an area of high priority by WDFW and is being considered as a potential site for wildlife mitigation activities by BPA.

The objectives of this study were to collect baseline information and determine current habitat values for the study area. A brief discussion of potential future management and a proposed listing of priorities for habitat protection are found near the end of this report. This report is a companion to a programmatic management plan being drafted for the area which will outline specific, management programs to improve habitat conditions based, in part, on this study.

The following narratives, describing limiting habitat variables, carry recurring themes for each indicator species and habitat type. These recurring variables that limited habitat value include: Waterbodies that lack emergent and submerged vegetation; forest areas that lack natural shrub layers; a predominance of non-hydrophytic and less desirable non-native plants where shrubs are present; a general lack of cover for ground nesting and secure waterfowl nest sites (island type). Human disturbance was the variable that varied more than any other from site to site in the study area.

One issue that the models we used do not truly deal with is the quantity and connectivity of habitat. The mallard and heron models deal with spatial relationships but for other species this may be as critical. Observation of habitat maps easily show that forested habitats are in short supply. Their continuity along Lake river and the Columbia has been broken by past development. Wetland distribution has also been affected by past development.

LOCATION:

The Vancouver lowlands are located in Southwest Washington in Clark County (figure 1). The area is north and west of the City of Vancouver. The area is comprised of Columbia River floodplain

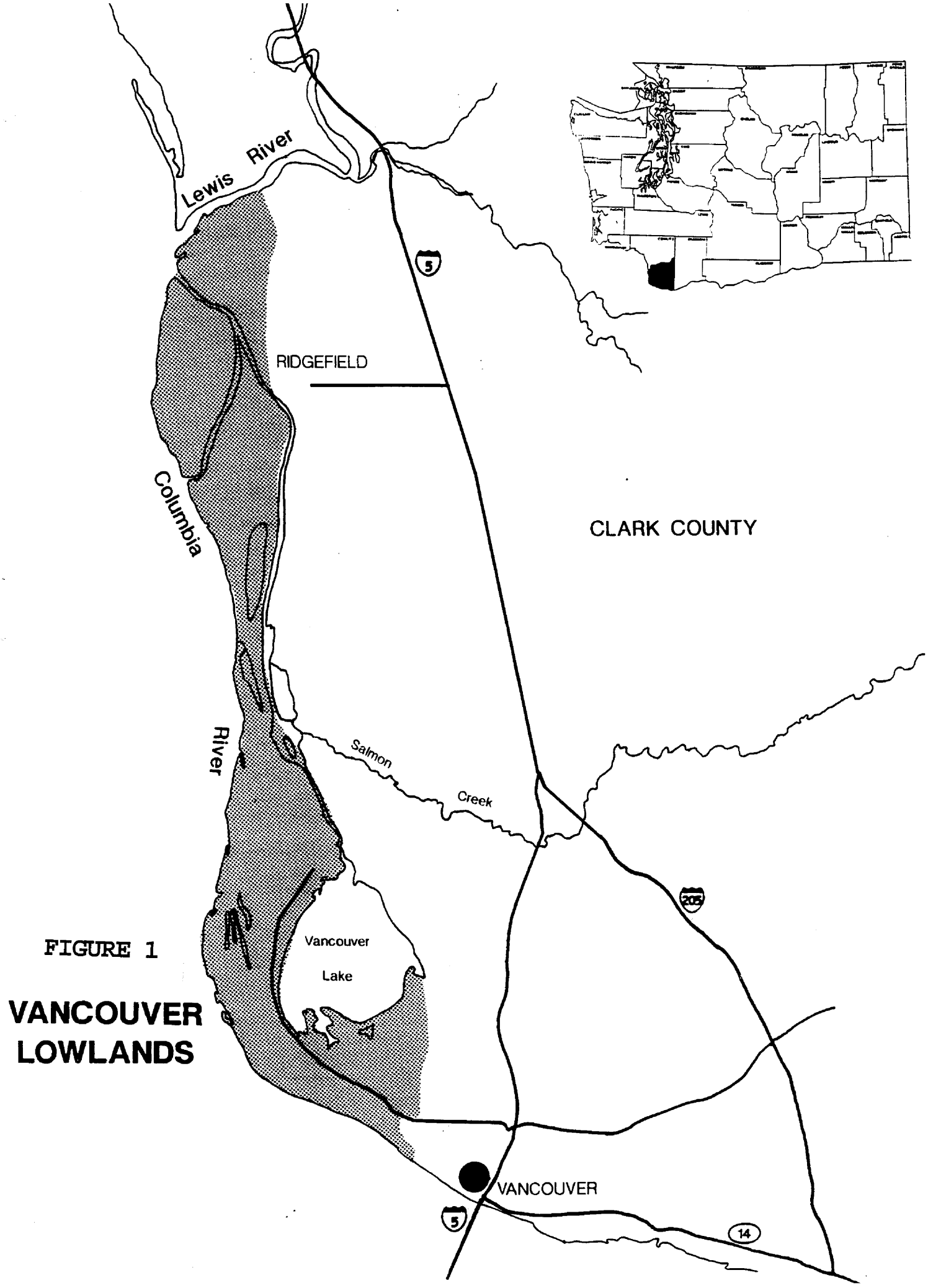


FIGURE 1

VANCOUVER LOWLANDS

beginning at the City limits of Vancouver and extending northward to the mouth of the Lewis River.

Most of the northern portion of the lowlands is within the boundaries of the 5147 acre Ridgefield National Wildlife Refuge. Our study focused on the area to the south which encompasses lands owned primarily by The Washington Department of Fish and Wildlife, Clark County, The Port of Vancouver, The Washington Department of Natural Resources, five major private landowners and other small private ownerships.

STUDY AREA:

Field studies were conducted on properties owned by WDFW, Chris Herzog, Hans Egger, and Fazio Brothers (New Columbia Gardens). Data from these ownerships was also used to assign habitat values to lands owned by the Rufener family, The Port of Vancouver, The City of Vancouver, and Clark County Parks and Recreation. The mapped study area (figure 2) is divided into two blocks. The first block, where most of the field sampling took place, is west of Vancouver Lake and Lake River, East of the Columbia River, North of the Vancouver Lake Flushing Channel and South of the Ridgefield National Wildlife Refuge. The second block is south of Vancouver lake and is bounded by SR 501 and a convoluted line to the east following orchard lands, and urban residential and industrial areas. The study area did not include Vancouver Lake but did include wetlands along its south and west shorelines.

GENERAL ENVIRONMENT:

The typically flat floodplain area is now almost entirely protected from flooding by dikes. The only remaining notable exception is the area known as Mulligan slough at the southern end of Vancouver Lake. Flooding in this area is much less severe now than it was historically due to the construction of dams upstream within the Columbia system.

The mild climate of the area is characterized by relatively warm summers and cool wet winters. Average annual precipitation is 39 inches. The average daily low and high temperatures are 44.2 and 62.7 degrees Fahrenheit respectively. The average annual snowfall is 5.9 inches. Prevailing winds are from the northwest in spring and summer and the southwest in fall and winter.

The most dominant feature of the area is Vancouver lake. The 2600 acre lake is naturally fed by two small creek basins and tidal back flow through lake river to the north. A man made canal was constructed in an effort to flush more water through the lake in an effort to improve water quality. Dredging of the lake was done for the same reason. One large island was created within the lake as mitigation for the impacts of the dredging. Many surrounding lands were impacted by the deposition of dredge

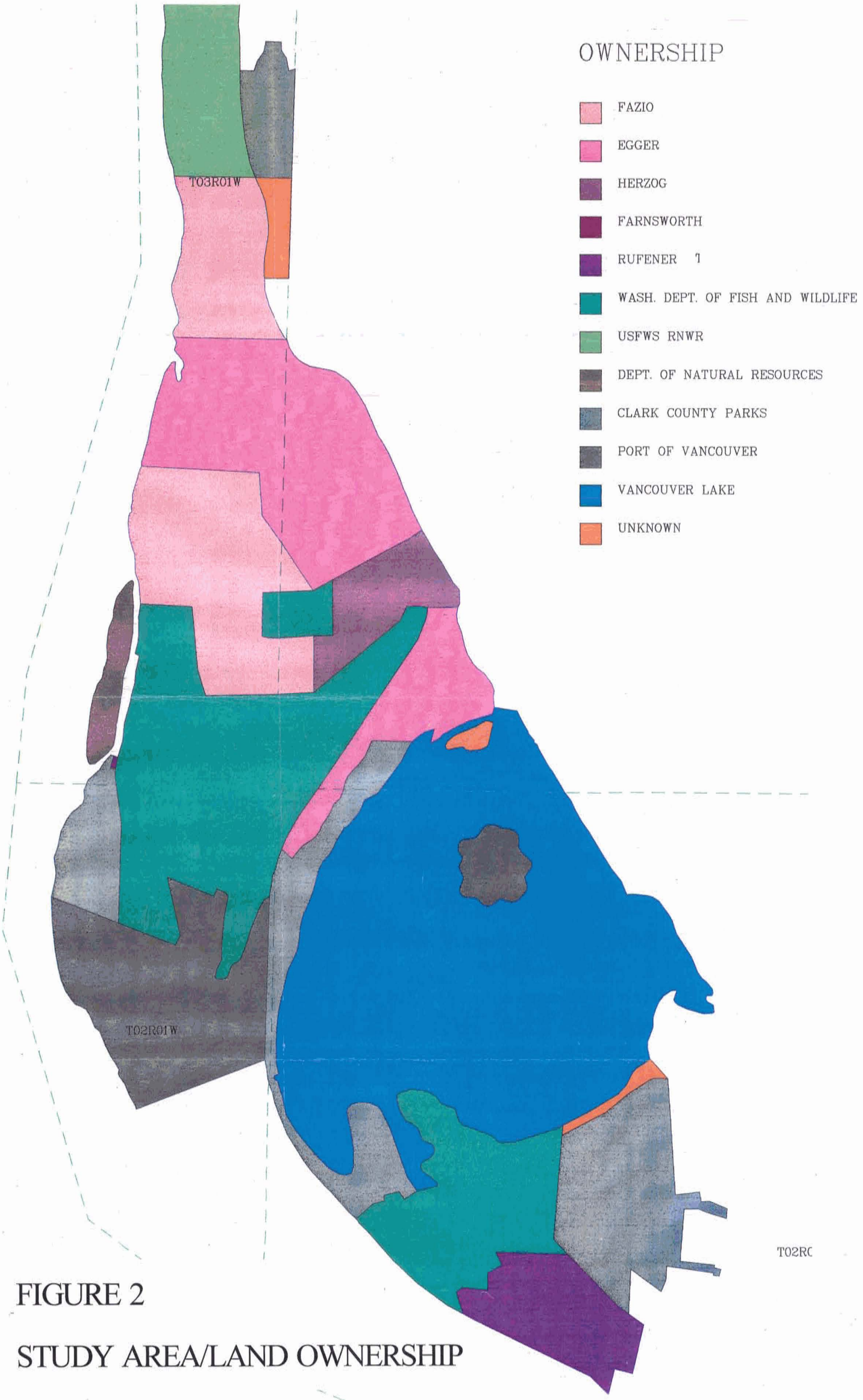


FIGURE 2

STUDY AREA/LAND OWNERSHIP

spoils from the restoration project.

The remaining lands were originally developed for agriculture and later in the extreme south for industry. The majority of the land within WDFW, Port, and Private ownerships is still used for agricultural purposes. The open crop and pasture lands are occasionally broken up by narrow riparian areas, small upland deciduous forests, brushy fencerows and ditch edges. The only large forested areas occur around Vancouver lake and in the Mulligan Slough area.

Part of the agricultural development included the draining of Shillapoo lake. This took place sometime around 1950. This lakebed, located northwest of Vancouver lake, is drained by an extensive system of ditches and a pump which discharges into Lake River. With the exception of the drainage ditches, the lakebed contains surface water only during the late fall, winter and early spring. This is due to the pump being shut off when crops are not being grown. The level of filling varies annually, dependant primarily on the amount of precipitation received.

Other large waterbodies include the Columbia River, Buckmire and Mathews Sloughs to the South and Post Office, Round, Green, Curtis, and Campbell lakes to the North. Many smaller wetlands occur throughout the area.

SOILS:

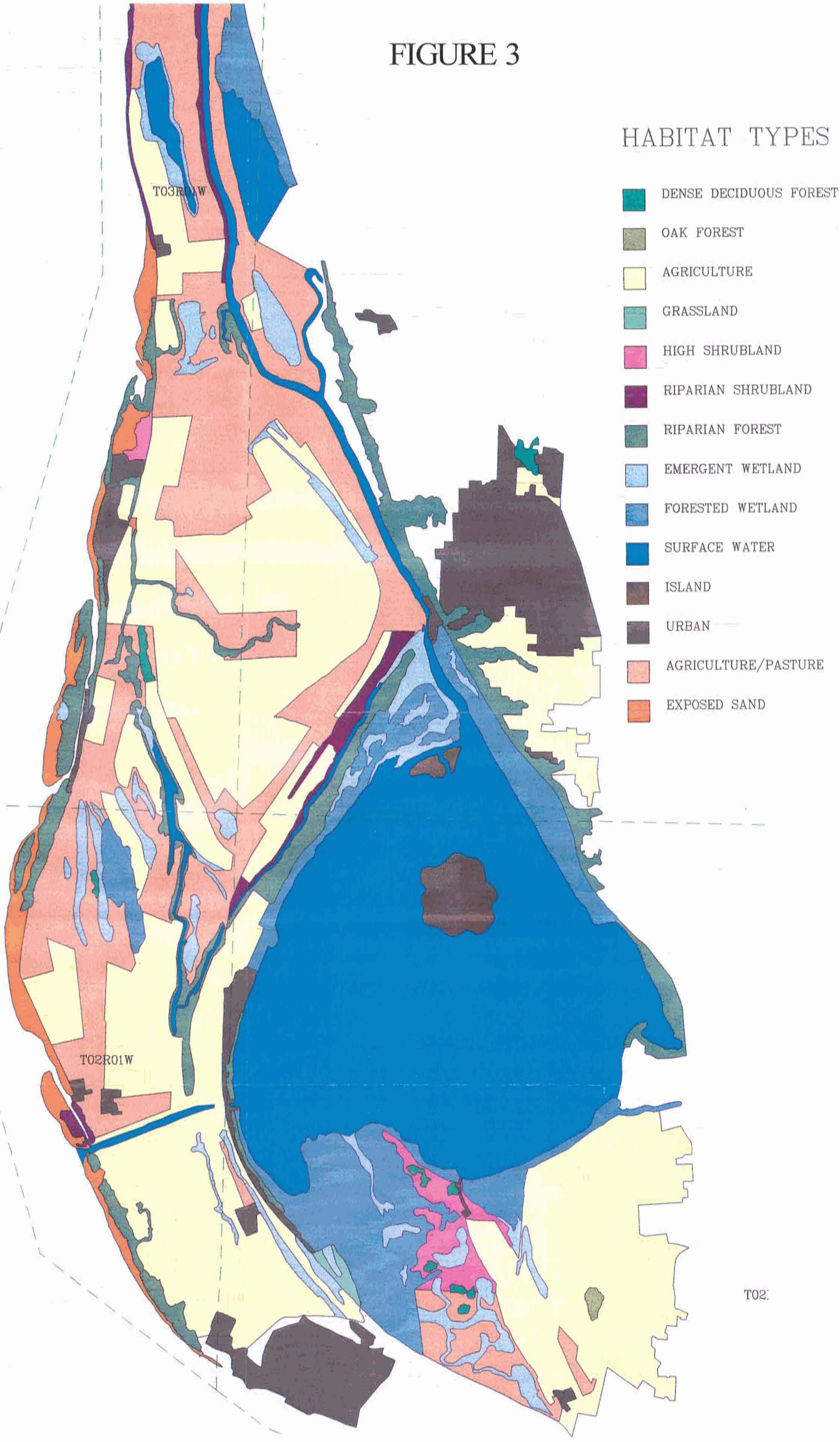
Soils in the area are primarily of the Sauvie-Puyallup association. These are described as "deep, nearly level to gently sloping, somewhat poorly drained to excessively drained, moderately fine textured to moderately coarse textured soils of the floodplains." Sauvie silt loam and sauvie silty clay loam are the most common types and are capable of growing most crops suitable to the area.

WILDLIFE HABITATS:

A habitat type map for the study area and the immediate surrounding area is presented as Figure 3. This was produced from 1:12000 scale orthophotos. Habitat types were traced onto mylar overlays which were later digitized into a GIS database. Layers for transportation, recreation and capitol features, and existing habitat improvements were produced, for purposes of management planning, using the same techniques. Sensitive species locations were plotted from WDFW's non-game database.

WDFW's wildlife area mapping and habitat classification system was used to maintain consistency with the agency's statewide wildlife area standards and guidelines. Fourteen habitat types were mapped and are described as follows:

FIGURE 3


T03R01W
T02R01W
T02
HABITAT TYPES
DENSE DECIDUOUS FOREST
OAK FOREST
AGRICULTURE
GRASSLAND
HIGH SHRUBLAND
RIPARIAN SHRUBLAND
RIPARIAN FOREST
EMERGENT WETLAND
FORESTED WETLAND
SURFACE WATER
ISLAND
URBAN
AGRICULTURE/PASTURE
EXPOSED SAND

AGRICULTURAL: This type consisted of areas intensively managed to produce crops for human or livestock consumption. Crops grown include barley, oats, silage corn, potatoes, cabbage and alfalfa. Other plants (weeds) encountered during field studies included grass species, yellow nutsedge, clover spp., mustards, redroot pigweed, poison hemlock, bindweed, etc.

During the dormant season most of the fields on the private lands are bare except for any volunteer grains or weeds that may sprout. This condition is due to the tillage of crop residue after harvest. The opposite is true on WDFW lands, where crop residue and stubble is typically left undisturbed until spring except for those fields that are planted to fall grain crops. No fall grain plantings are known to take place on private lands within the study area.

Due to their small size, drainage ditches and associated vegetation were generally included in this type.

AGRICULTURAL PASTURE: This habitat included all areas where cattle grazing took place and primarily supported grasses and forbs. Tree, shrub and wetland areas that were too small to map were included in this type. The pastures within the study area could generally be classified as unimproved. Reseeding has not taken place in the recent past.

Grasses including reed canary grass, orchard grass, and quackgrass are the predominant plants in most of the pastures but some areas currently support clovers. Clover appears to be more predominant in areas where grazing pressure is higher. All of the pastures are infested with canadian thistle to some degree. Other commonly encountered plants include: Bull thistle, Scotch thistle, milk thistle, smartweed, Tansy Ragwort, common tansy, poison hemlock, plantain, teasel, fennel, chicory, and catsear.

Trees consisting of Oregon ash, cottonwood, and Oregon white oak are uncommon and scattered in the pastures. Shrubs within the pastures were more prevalent on WDFW properties than on other lands. Himalayan blackberry was the most common shrub in the pastures although rose species are also present.

RIPARIAN FOREST: This type included all forested areas adjacent to or near water excluding forested wetlands. These forest areas generally are quite narrow.

Oregon Ash and Cottonwood are the most common overstory plants. Oregon white oak and mature willows were encountered.

Himalayan Blackberry and snowberry are the most common understory shrubs. Other common shrubs include: Trailing blackberry, redosier dogwood, willow spp., rose spp., red elderberry, and serviceberry.

RIPARIAN SHRUB: This type was also adjacent to water but was dominated by shrubs. Common shrubs included Himalayan blackberry, rose spp., red elderberry, serviceberry, and willow. Reed canary grass and canadian thistle were common in these areas as well.

EMERGENT WETLAND: These areas maintain surface water during some portion of the year and are not dominated by tree species. The most predominant plant in this type is reed canary grass. Other plants found included: smartweed, spike rush, common rush, wapato, duck potato, cattail, and water plantain.

Smaller wetlands that were not practical to map are included in the surrounding habitat type. No portion of the Shillapoo lakebed was mapped as wetland except those larger areas that contained surface water during most of the year. Agricultural and pasture designations more accurately reflect the condition of these areas during most of the year.

FORESTED WETLAND: This type also supports surface water during a portion of the year but is dominated by tree species including mature willow. Other tree species included cottonwood and Oregon ash. Reed canary grass is the dominant understory plant in the willow dominated wetlands south of Vancouver Lake. Shrubs associated with this habitat type were: rose spp., snowberry, Himalayan blackberry, and redosier dogwood.

DENSE DECIDUOUS FOREST: This type only occurred on WDFW lands within the study area. The overstory in these areas is comprised of Cottonwood, Oregon ash, and Oregon white oak. The typically dense shrub layer included snowberry, himalayan blackberry, redosier dogwood, serviceberry, red elderberry, trailing blackberry, and sapling forms of the overstory trees.

OAK FOREST: This type only occurred within the City of Vancouver ownership south of Vancouver Lake. The area was not surveyed but is dominated by Oak and cottonwood. Small concentrations of large Oaks within the study area indicate that this type may have occurred here, on a larger scale, prior to agricultural development. One of these trees found on the Egger property measures 5 1/2 feet DBH. Two other trees nearby have recently been cut down.

GRASSLAND: The only mapped examples of this type within the study occurred on WDFW land, south of Vancouver Lake, where grazing does not currently take place. Common plants include reed canary grass, quackgrass, tiesel, and Canadian thistle. All of these areas have been grazed in the past and serve as an example of conditions that would exist if grazing were eliminated in other areas.

HIGH SHRUBLAND: This type is also limited primarily to the Vancouver Lake Wildlife Area. These areas are similar to grassland habitats but shrub density is higher. Shrubs found are primarily rose, himalayan blackberry and willow.

SURFACE WATER: This habitat includes areas that are predominantly open water. Emergent plants are scarce or not present. Submerged aquatic plants are present but scarce in most of these larger waterbodies. This is presumed to be due to the abundance of carp in the area. Submerged plants encountered include: Grazed reed canary grass, sago pondweed, curly leaf pondweed, bladderwort, duckweed, and smartweed.

ISLAND: These areas as the name implies are defined as islands within a waterbody that are more than 20 feet from the shoreline. The type is mapped separately due to the importance of islands to select species that use them to avoid predators during the breeding season.

EXPOSED SAND: This type is only found along the shoreline of the Columbia river. These areas were created by the deposition of dredge spoils. The dry sands only support sparse stands of vegetation made up of grasses and knapweed species. These habitats were not sampled because they were presumed to be of low value to the indicator species selected for this study.

URBAN: This designation was given to areas over five acres in size that are developed for human housing, industry, recreation, or farm headquarters and associated feedlot operations. These areas were also presumed to have low wildlife value and were not sampled.

METHODS:

A habitat evaluation procedure (HEP) was conducted to determine the habitat quality for selected indicator species within the Wildlife Area Lands and the proposed acquisition areas.

HEP gives a per acre habitat value from 0 to 1 (1 is considered optimum) for each species. Each species model is based upon a mathematical equation which includes habitat variables that can be measured in the field, from maps, or photos. Each habitat variable relates to a continuum that assigns a value for that one parameter. The model equation calculates a habitat suitability index (HSI) that is based upon the relative importance of each variable.

The majority of all habitat polygons within the target acquisition area between Lower River Road and Lake River were sampled. Exceptions occurred where a habitat polygon continued across an ownership boundary or was essentially identical to others already sampled. Selected polygons were sampled on WDFW

properties based on their uniqueness or likelihood of future enhancement. Some additional sites on WDFW lands were selected for comparison. (Note: agricultural sites on WDFW land were not sampled in the field because they were presumed to be essentially identical to those on private lands during the growing season.)

Starting points for each sampled polygon were randomly selected on the habitat maps using a dot grid and a random number table. The first transect was located at this start point. With the exception of smaller polygons, subsequent transects or plots were 100 paces apart (approximately 500 feet) in a direction chosen from a random number table. Three or more sites were sampled in each polygon except small polygons where only one or two sites were done.

Indicator species were selected using the following criteria:

1) The species model represented a species or habitat condition that is considered a priority within the study area.

2) To the extent possible species models used in the Bonneville Dam impact study should be included.

Models for yellow warbler, mallard, dabbling duck, breeding canada goose, wintering canada goose, great blue heron, black capped chickadee, western meadowlark, and mink were used in the study.

Variables included in these models and the sampling techniques used per habitat type were as follows:

RIPARIAN AND WETLAND HABITATS:

Sampling in these habitats began at the closest point to the waters edge from the start point on the maps. Three transects started from this point. The first transect was 328 ft. (100 meters) long and ran perpendicular to and out from the waters edge. The second transect, 100 feet in length, followed the waters edge in a direction determined by flipping a coin to eliminate any bias. The third transect extended across the water to the opposite shoreline. In larger waterbodies a boat was used to collect data and the original points were not used but a larger area was sampled.

% TREE CANOPY COVER was estimated in one of two ways. In areas where an extensive area was to be sampled a forest desiometer was used every 30 feet along the 328 ft. transect until the transect left the habitat type. The line intercept method was used in areas with sparse tree canopies and where the habitat type was exceptionally narrow.

AVERAGE HEIGHT OF OVERSTORY was estimated by triangulation using a clinometer to estimate the height of representative trees that were providing canopy cover over the transect.

SNAGS PER ACRE was estimated by counting the number of snags within the habitat type and within 10 ft of the 328 ft. transect. The acreage covered in the 20 ft X variable length transect was calculated and converted to snags per acre. Although the model used only included 4 to 10 inch DBH snags, larger snags were tallied separately for possible later use. Snag DBH was determined using a forester's stick.

% CANOPY COVER OF TREES AND SHRUBS WITHIN 100m (328 ft) OF SHORELINE was estimated using the line intercept method. We avoided duplication of effort by noting that closure over 75% would receive a value of "1" in the model concerned. If either overstory or shrub cover was over this level separate data was not collected.

% DECIDUOUS SHRUB CROWN COVER was estimated using the line intercept method. This was measured along the 328 ft. transect until it left the habitat type.

% OF DECIDUOUS THAT ARE HYDROPHYTIC was estimated by noting separately any coverage of hydrophytic shrubs and determining the percentage of the shrub cover provided by this shrub type. Hydrophytic shrubs encountered included: willow spp., red elderberry, sapling forms of cottonwood and Oregon ash, and redosier dogwood.

AVERAGE HEIGHT OF DECIDUOUS SHRUBS was estimated by measuring the height of each shrub, or group of shrubs, over the transect to the nearest 1/2 foot . Where groupings of shrubs were extensive their height was measured at several points.

% COVER WITHIN 1m OF SHORELINE was estimated by placing a meter stick perpendicular to the transect at the waters edge at each ten foot mark. The percentage of cover intercepting the one meter transects was recorded and averaged. As specified in the mink model, live vegetation, debris and cut banks were included in this cover estimate.

EMERGENT COVER TO OPEN WATER RATIO was estimated by recording the distance of the water transect covered by emergent vegetation capable of hiding a duckling from predators. In larger waterbodies this data was collected from a boat at transect sites that may have differed.

% COVER OF EMERGENT VEGETATION was estimated using a modified plot frame at ten foot intervals along the water transect to measure the water surface area covered by emergent vegetation. In larger waterbodies this information was collected from a boat

as noted above.

WATER DEPTH was estimated by measuring the water depth to the nearest 1/2 foot at ten foot intervals along the water transect. This data was also collected from a boat in larger waterbodies. When working from a boat we had to estimate the ten foot intervals by poling the boat with the graduated pole.

% COVER OF SUBMERGED VEGETATION was estimated using a modified plot frame to measure the cover of submerged plants. Floating plants such as duckweed that are also desirable to ducks as forage were included in this estimate. In turbid water where the plants could not be readily seen from the surface the sampler felt the bottom of the pond or lake under the frame to arrive at an estimate.

DISTANCE BETWEEN WETLAND WITH EMERGENT COVER AND DUCK NEST AREA was estimated as to whether it was greater or less than one quarter mile in the field. Otherwise this was estimated from maps.

HEIGHT OF RESIDUAL DUCK NESTING COVER was estimated by measuring the height of residual vegetation from the previous growing season at ten foot intervals along the 328 foot transect until the habitat type ended. In some areas that had been impacted by grazing or a large amount of regrowth this had to be estimated from local knowledge or at a small number of points. This variable was considered not applicable in areas with dense shrub canopies or in areas that typically receive high grazing pressure where ducks would not be expected to nest.

HERON FORAGE HABITAT QUALITY was determined from a word model assigning a value of 1 to shallow clear water with a firm substrate and forage fish, .5 to wet pasture areas, and 0 to areas without quality forage conditions. This word model was treated more as a continuum as these areas with turbid water or high numbers of amphibians receive a tremendous amount of foraging activity from herons. To this end amphibians were considered equivalent to fish and resulted in a value of one. Turbid water areas were generally given a value of .75 if a firm substrate and fish population were present.

The following habitat variables were determined from maps or aerial photos: Distance between heron nest site and feeding area, Distance between active and potential heron nest site, the presence of islands, and the number of islands per acre of open water. Local knowledge was used to define or determine human disturbance levels, the percent of year that surface water is present, and the presence of nesting areas for Canada Geese.

DECIDUOUS FOREST HABITATS:

A 66 ft. X 66 ft. (1/10 acre) square plot was sampled at each selected point in this habitat type.

% TREE CANOPY COVER was estimated using a forest desiometer at each corner of the square plot.

AVERAGE HEIGHT OF OVERSTORY was estimated by triangulation using a clinometer to estimate the height of representative trees within the plot.

SNAGS PER ACRE was estimated by counting the number of snags within the square plot. This count was then multiplied by ten for a per acre estimate. A foresters stick was used to determine the number of snags within the 4 to 10 inch DBH range. Larger snags were also tallied for possible later use.

AGRICULTURAL AND PASTURE HABITATS:

A 100 foot transect which ran in a randomly selected direction was used to sample these habitats.

HEIGHT OF HERBACEOUS CANOPY was estimated by measuring the height of the tallest herbaceous plant over each 10 foot mark. Measurements were recorded to the nearest 1/2 foot and averaged.

% COVER OF HERBACEOUS PLANTS was estimated using a modified plot frame to measure the amount of herbaceous ground cover.

% OF HERBACEOUS CANOPY THAT IS GRASS was estimated using the plot frame to compare the amount of cover provided by grasses and forbs.

% SHRUB CANOPY COVER was estimated using line intercept technique along the transect.

AVERAGE HEIGHT OF SHRUBS was estimated by measuring the height of each shrub or group of shrubs encountered on the transect and averaging the measurements.

DISTANCE TO MEADOWLARK PERCH SITE was estimated visually from the start point of each transect. Occasionally these estimates were verified by pacing the distance or by using the transect tape.

CONDITION OF GOOSE BROOD AREA was determined using the word model describing the condition of the area.

The distance to the nearest waterbody, size of nearest waterbody, crop type, Presence of goose nest areas, distance from goose brood to nest area, human disturbance level, distance from duck nest area to wetland with emergent cover, and human or livestock

disturbance was defined or measured from maps and aerial photos or local knowledge.

GRASSLAND AND SHRUBLAND HABITATS:

The methods used in these types were the same as those for agricultural and pasture habitats except these areas were presumed to be unsuitable for brood rearing geese. This item was left off of the data sheets.

RESULTS:

The following is a discussion of the results of this habitat evaluation. Each ownership is discussed individually addressing limiting variables for each evaluation species. Actual field data is not discussed. Total habitat units for each parcel in the study area are summarized in Table 1.

HERZOG PROPERTY:

The Herzog property consists solely of pasture and agricultural habitats. The lack of other habitat types caused HSI values to be zero for Yellow Warbler, Black Capped Chickadee, Dabbling Duck, and Mink. Total habitat units for the parcel are summarized in Table 2.

Western Meadowlark HSI was .25 in pasture habitat and zero in agricultural habitat. Agricultural sites were generally considered to be of low value to Meadowlark due to the absence of grasses in the stand. The primary factor limiting habitat value for Meadowlark in these pastures was distance to perch site. Herbaceous canopy height and percent canopy comprised of grass were also at suboptimal levels.

Breeding goose HSI was .4 in pasture and .2 in agricultural habitat. The key limiting factor was the absence of secure nesting sites. The brood area condition was also limiting in the agricultural sites due to late planting dates in the area and presumed rapid growth that would make the crop stands unusable to geese during most of the breeding season. Human disturbance levels were a factor in the pasture. This was due to water skiing activity and the proximity to a marina on Lake River.

Wintering goose HSI values were 1 and .5 respectively in pasture and agricultural habitat. Although weeds (thistle) were present in the pasture the overall condition was good with clover and other legumes present. Crop type was the limiting factor for agricultural sites. This is due to the current management type with no crop left in the field or other provision made to provide a food source for geese.

Mallard HSI values were zero and .14 in agricultural and pasture

TABLE 1

EXISTING HABITAT UNIT VALUES BY OWNERSHIP

Ownership/acres	Herzog **197**	Egger Parcel A **754**	Egger Parcel B **266**	Fazio Parcel A **550**	Fazio Parcel B **264**	WDFW Shillapoo **1019**	WDFW Chapman **64**	WDFW Van. Lk **469**	Rufener **271**	Port of Vancouver **639**	Clark Co. Fr. Bar **147**	Clark Co. Van. Lk. **320**	Clark Co. S. Van. Lk. **285**	City of Vancouver **130**
Species Model:														
Mink	0.00	38.30	96.58	15.70	24.20	85.79	5.40	47.40	0.15	37.50	24.05	96.25	3.63	0.00
Western Meadowlark	18.17	121.70	2.35	62.30	75.52	232.70	27.50	0.00	0.00	162.15	21.40	28.00	0.00	0.00
Yellow Warbler	0.00	25.10	119.36	13.40	21.40	77.44	4.50	251.20	1.00	28.75	32.00	206.10	2.31	0.00
Black Capped Chickadee	0.00	26.90	115.40	13.00	20.40	8.25	4.05	183.00	0.75	6.00	36.00	189.25	0.00	0.00
Heron	19.60	154.00	53.47	44.80	48.00	311.83	27.50	38.00	133.50	96.50	7.63	89.00	5.50	7.00
Canada Goose (breeding)	49.20	206.20	22.60	103.70	67.04	188.00	16.50	34.10	98.82	123.00	32.77	9.40	58.65	24.60
Canada Goose (winter)	123.00	458.95	18.80	306.65	130.80	655.60	49.50	28.20	217.00	267.60	69.70	36.00	137.00	61.50
Mallard	6.86	126.20	71.00	8.90	20.99	80.10	11.00	105.20	217.00	22.80	12.45	39.00	0.00	0.00
Dabbling Duck	0.00	1.50	31.50	10.50	0.00	46.55	3.60	127.00	11.95	7.81	0.00	69.75	4.18	0.00

TABLE 2

EXISTING HABITAT UNIT VALUES BY HABITAT TYPE

Ownership: HERZOG

Habitat Type/Acreage:	**Pasture** (49 acres)	**Agricultural** (148 acres)	**Total** (197 acres)
Species Model:	**HU's**	**HU's**	**Total HU's**
Mink	0.00	0.00	0.00
Western Meadowlark	12.25	5.92	18.17
Yellow Warbler	0.00	0.00	0.00
Black Capped Chickadee	0.00	0.00	0.00
Heron	19.60	0.00	19.60
Canada Goose (breeding)	19.60	29.60	49.20
Canada Goose (winter)	49.00	74.00	123.00
Mallard	6.86	0.00	6.86
Dabbling Duck	0.00	0.00	0.00

habitats. These values were low due to low residual height of nesting cover and a lack of cover in agricultural habitat.

Heron HSI was zero in agricultural habitat as our presumption was that areas that were cropped annually had little or no food value for herons. The HSI in pasture was .4. The limiting factor was distance to a potential heron nest. The lowered value for forage quality is due to the nature of the site being upland and is not considered limiting.

EGGER PROPERTIES:

The Egger property was divided into two portions for purposes of evaluation. The first portion (Egger parcel A) was the larger, located between the Columbia and Lake River which included the Northern portion of the Shillapoo lakebed. The Second (Egger parcel B), smaller parcel was located along the northwestern shoreline of Vancouver Lake. The two properties are not contiguous. Total habitat unit values for Egger parcel B may include a small portion of land owned by Clark County. We had difficulty mapping this boundary which is near the confluence of Lake River and Vancouver Lake.

Egger parcel A also consisted primarily of agricultural and pasture habitats. Mappable areas of riparian forest and wetland did occur in small quantities within this ownership. Other wetlands, currently too small to map, were located within the pastures. These smaller wetlands were taken into account in determining distance to emergent cover for mallard if this was deemed reasonable in the field.

Some habitat polygons within this ownership were not directly sampled in the field. This was only done where we could make the assumption that conditions were essentially identical to other polygons sampled within the study area and it was reasonable to apply the same HSI values. These sites were generally small or contiguous with polygons sampled on other ownerships.

Total habitat units for Egger parcel A are summarized in Table 3.

HSI values for Meadowlark were .3 in the pastures and .7 in one agricultural field that was in a permanent hay type crop. The primary factor limiting habitat quality for this species in the pastures was distance to perch site. Pastures within this ownership consisted primarily of one large open expanse with few interruptions of fences or shrubs suitable for use as a perch. The agricultural field received a higher value because it was long and narrow with perch sites on both sides. Canopy height and percent canopy comprised of grass were limited the overall quality of this site.

Breeding goose HSI values were .4 in pasture and .2 in

TABLE 3

EXISTING HABITAT UNIT VALUES BY HABITAT TYPE

Ownership: EGGER PARCEL A/Shillapoo lakebed

Habitat Type/Acreage:	Pasture (345 acres	Agricultural (301 acres)	Riparian Forest (28 acres)	Emergent Wetland (33 acres)	Shrubland (13 acres)	Exposed (21 acres)	Urban (13 acres)	Total (754 acres)
Species Model:	HU's	HU's	HU's	HU's	HU's	HU's	HU's	Total HU's
Mink	0.00	0.00	22.00	16.30	0.00	0.00	0.00	38.30
Western Meadowlark	103.50	18.20	0.00	0.00	0.00	0.00	0.00	121.70
Yellow Warbler	0.00	0.00	14.00	11.10	0.00	0.00	0.00	25.10
Black Capped Chickadee	0.00	0.00	26.90	0.00	0.00	0.00	0.00	26.90
Heron	138.00	10.40	0.00	5.60	0.00	0.00	0.00	154.00
Canada Goose (breeding	138.00	60.20	5.20	2.80	0.00	0.00	0.00	206.20
Canada Goose (winter)	293.25	165.70	0.00	0.00	0.00	0.00	0.00	458.95
Mallard	69.00	20.80	0.00	26.00	10.40	0.00	0.00	126.20
Dabbling Duck	0.00	0.00	0.80	0.70	0.00	0.00	0.00	1.50

agricultural habitat. Limiting factors were the lack of secure nesting sites, and the proximity of the pastures and aglands in relation to suitable brood water. The portion of round lake lying within this ownership received a value of .4. Human disturbance, primarily through intensive cattle grazing, and having nesting sites only along the shoreline were limiting factors. Riparian forest habitats were assigned values of .2 for breeding goose as potential nest sites.

Wintering Goose values were .85 in pastures and .5 for most of the agricultural habitat. One agricultural field was assigned a higher value of .9. This was due to a difference in crop type (alfalfa). Limiting factors were pasture condition (unimproved) and the absence unharvested crops or planted winter crops (crop type).

Mallard HSI values were .2 in pasture areas and zero for most of the agricultural land. Again we assigned a higher value of .8 to the field which was in a permanent crop. Height of residual cover was the limiting factor in the pastures and permanent cropland. The remaining annual cropland received zero values due to the absence of suitable nesting cover. One wetland within the parcel was assigned an HSI value of 1 for mallard. This relatively undisturbed site provided good nesting cover. One small site typed as shrubland received a value of .8 as mallard nesting habitat.

Heron HSI values were .4 in the pasture and permanent cropland. The model indicates that, upland sites have lower potential value to herons as feeding areas. Distance to potential nest sites was also limiting. Annual cropland was considered to be of little value as heron feeding habitat. Wetlands within the parcel received values ranging from 0 and .8. One site was considered unusable due to tall rank cover. The second was limited only by it's distance to a potential nest site. Riparian forests within the parcel were generally considered unsuitable for heron nesting and received HSI values of zero. The riparian forests were still young with relatively tight canopies not suitable for use by herons. The stands are approaching mature stages and the canopy should open in the near future, if left undisturbed, and provide potential nest sites.

Mink HSI values were .6 to .8 in riparian habitat and .1 to .6 in wetlands. Key factors influencing habitat values included: Shoreline cover, Cover within 100 meters, shrub and emergent cover. Percent of year with water also was a limiting factor for the portion of Round Lake within the Egger property.

Yellow Warbler HSI values were .1 and .4 in wetlands and .5 in riparian forests. The low to moderate values were due to a lack of shrubs, particularly hydrophytic shrubs, in the forest stands and near wetlands.

Black Capped Chickadee HSI values were zero in all types except riparian forest. Riparian forest stands were generally excellent Chickadee habitat, with HSI values of 1, except in one instance where overstory height was limiting. The resulting HSI value in this polygon was .45.

Dabbling Duck values were assigned to the portion of Round lake on this parcel and one small riparian site. HSI values were low (.1) in the wetland due primarily to shallow water depth and water only being present for a short period of time each year. The riparian forest received a value of .4. As with most waterbodies in the area, low levels of emergent cover and submerged vegetation were the most limiting factors.

Egger parcel B was unique among the private lands sampled in the field. The parcel contains a small percentage of land that is currently under cultivation. Grazing currently does not occur on this site. As a result, this site provided higher habitat values for some species that were low throughout most of the remaining study area. The remainder of the property is comprised of riparian shrub and forest, herbaceous and forested wetlands. Because of their uniqueness, most of the major habitat polygons were sampled in the field. The information gathered should prove helpful in estimating future HSI values of other areas after enhancement activities take place. HSI values derived from sampling within willow dominated forested wetlands on WDFW lands were used for sites within this ownership which appeared to be similar, if not identical in habitat value.

Total HU's for the parcel are summarized in Table 4. We considered the undeveloped highway easement as part of the ownership. If the highway is completed, over half of the HU values listed for riparian shrub would be lost.

HSI values were zero for meadowlark except in Agricultural Habitat. The HSI in this type was .05. Approximately one half of the agricultural acreage was in alfalfa which has some value to meadowlark based on the model. The key limiting factors in this crop type for Meadowlark are the percent of the canopy that is grass and the distance to perch site. Herbaceous canopy height is limiting during certain portions of the growing season when the stand is too tall to be favorable for use.

Breeding goose HSI values also only applied to agricultural habitat. The value of .2 resulted from the possible use of the site as a brood area even though access to a large waterbody and prime nest sites is restricted. Human disturbance is presumed to be high in this polygon due to the close proximity to a road.

Goose winter habitat HSI values were .4 in agricultural habitat. The factor limiting habitat value was crop type. The value was higher than for most other private ownerships due to the high

TABLE 4

EXISTING HABITAT UNIT VALUES BY HABITAT TYPE

Ownership: EGGER PARCEL B/Vancouver lake area

Habitat Type/Acreage:	**Agricultural** (47 acres)	**Riparian Forest** (40 acres)	**Emergent Wetland** (66 acres)	**Riparian Shrubland** (50 acres)	**forested wetland** (63 acres)	**Total** (266 acres)
Species Model:	**HU's**	**HU's**	**HU's**	**HU's**	**HU's**	**Total HU's**
Mink	0.00	40.00	0.00	43.98	12.60	96.58
Western Meadowlark	2.35	0.00	0.00	0.00	0.00	2.35
Yellow Warbler	0.00	28.00	0.00	28.36	63.00	119.36
Black Capped Chickadee	0.00	40.00	0.00	25.00	50.40	115.40
Heron	4.70	40.00	0.00	8.77	0.00	53.47
Canada Goose (breeding)	9.40	0.00	13.20	0.00	0.00	22.60
Canada Goose (winter)	18.80	0.00	0.00	0.00	0.00	18.80
Mallard	0.00	0.00	66.00	5.00	0.00	71.00
Dabbling Duck	0.00	0.00	0.00	0.00	31.50	31.50

percentage of the farmland that was in alfalfa which is considered more valuable than other crop types under private management.

Mallard HSI values were .1 in riparian shrub and 1.0 in emergent wetland. Although a large portion of the riparian shrub site has shrub densities too high to make it a reasonable mallard nest site the key limiting factor is human disturbance. The site receives heavy, uncontrolled use by four-wheel drive vehicles, ORV's, and people target practicing with firearms. One emergent wetland was evaluated as a nest site using the mallard model due to the low water levels on the site. This wetland was an excellent area for nesting although it was dominated largely by Canary grass.

HSI values for heron were .1 in agricultural and .2 in riparian shrub. The riparian forest occurring in this ownership received a value of 1.0. The forest canopy is approaching the open criteria which makes it potentially suitable as a heron nest site. The alfalfa portion of the agland was considered "wet pasture" for purposes of the model. Human disturbance was considered a limiting factor in both riparian shrub and agricultural areas but not in riparian forest. Human disturbance to the forest site is currently low as the landowner is making an effort to prevent trespass here.

Mink HSI was 1.0 in riparian forest, .9 in riparian shrub and .15 in forested wetland. The percent of year when water is present was presumed to be limiting in forested wetland but other variables were at or near the upper levels of the suitability range. Although none of the variables were at optimum the most limiting factor in riparian shrub was the cover within 100 meters of water. The percent emergent canopy cover was very low on this site but was not limiting in the equation due to the habitat type. The riparian forest on this site was in excellent condition based on most of the models used in this type.

Yellow Warbler HSI values were 1.0 in forested wetland, .6 in riparian shrub, and .7 in riparian forest. The forested wetlands in the study area are excellent yellow warbler habitat based on the model. The shrub canopy cover and percent of the shrubs that were hydrophytic limited the habitat value of riparian forest and shrub areas. This is presumed to be due to past disturbance followed by drier site conditions when shrubs reestablished themselves on the site. The drier conditions would have allowed more competitive non-hydrophytic plants to establish themselves in the area.

HSI values for Black Capped Chickadee were 1.0 in riparian forest, .75 in forested wetland, and .5 in riparian shrub. The limiting factors were overstory height and tree canopy cover in riparian forest and shrub. Density of snags within the 4 to 10

inch range were above optimum (2/acre) levels in all habitat types.

An HSI value of .5 was assigned to forested wetlands for Dabbling Duck. Low water depth, the lack of submerged vegetation, and absence of islands were limiting factors for dabbling duck in these areas.

FAZIO PROPERTIES:

The properties owned by Fazio Brothers, or New Columbia Gardens, were also divided into two parcels for purposes of evaluation (Fazio Parcel A and B). Both sites consist primarily of agricultural and pasture habitat. With the primary exception being those areas West of Lower River Road on both sites. These areas were typed primarily as Riparian Forest, Exposed, and Urban. Parcel B had a significant amount of existing emergent wetland habitat which made it unique among the private ownerships in the Northern part of the study area.

Fazio Parcel A, contains the west central portion of the Shillapoo lakebed, adjoining higher elevation sites, and the Columbia River Shoreline area west of Lower River Road. The Farm operation center, feedlot, exposed sand dredge spoils, and a sand mining operation are included in this site but were not assigned HU values due to presumed high disturbance levels or other factors limiting use by the evaluation species. Total HU's for this parcel are summarized in Table 5.

An HSI value of .7 for meadowlark was assigned to pastures in this parcel. All variables were at optimum levels except the distance to perch site. These pastures are very open and are not interrupted by shrubs or cross fences that could serve as a perch.

Breeding goose HSI values were .3 in pasture and .2 in agricultural habitat. The proximity of the areas to water and the lack of optimum nest sites were limiting factors for breeding goose.

Wintering Goose HSI values were .9 in pasture and .6 in agricultural types. The "unimproved" nature of the pasture and the tillage of crop residue in the agricultural lands, following harvest, limited habitat quality for this species.

The HSI for Mallard was .1 in pastures. The height of residual cover and human disturbance through cattle grazing were the primary factors limiting habitat quality in this model.

Heron HSI was .5 in pasture and .25 in the one small polygon mapped as emergent wetland on the parcel. The distance to a potential heron nest site was near optimum for the pastures. The

TABLE 5

EXISTING HABITAT UNIT VALUES BY HABITAT TYPE

Ownership: FAZIO PARCEL A/Shillapoo lakebed

Habitat Type/Acreage:	**Pasture** (89 acres)	**Agricultural** (385 acres)	**Riparian Forest** (26 acres)	**Emergent Wetland** (1 acre)	**Urban** (36 acres)	**Exposed** (13 acres)	**Total** (550 acres)
Species Model:	**HU's**	**HU's**	**HU's**	**HU's**	**HU's**	**HU's**	**Total HU's**
Mink	0.00	0.00	15.60	0.10	0.00	0.00	15.70
Western Meadowlark	62.30	0.00	0.00	0.00	0.00	0.00	62.30
Yellow Warbler	0.00	0.00	13.00	0.40	0.00	0.00	13.40
Black Capped Chickadee	0.00	0.00	13.00	0.00	0.00	0.00	13.00
Heron	44.50	0.00	0.00	0.30	0.00	0.00	44.80
Canada Goose (breeding)	26.70	77.00	0.00	0.00	0.00	0.00	103.70
Canada Goose (winter)	75.65	231.00	0.00	0.00	0.00	0.00	306.65
Mallard	8.90	0.00	0.00	0.00	0.00	0.00	8.90
Dabbling Duck	0.00	0.00	10.40	0.10	0.00	0.00	10.50

calculated HSI value was almost optimum for a pasture. The HSI value for the wetland was presumed to be the same as for a similar pond area on WDFW land where forage quality and human disturbance were limiting factors.

Mink received an HSI of .6 in riparian habitat and a value of .1 in the wetland mentioned above. Factors limiting habitat suitability in riparian habitat were: cover within 100 meters, shrub canopy cover, and emergent canopy cover. Cover at the waters edge (within one meter) was near optimum levels.

An HSI of .5 was calculated for yellow warbler in Riparian habitat. The habitat value was limited by the percent shrub cover and the percent of the shrub canopy made up of hydrophytic shrubs. A value of .4 from the WDFW wetland was assigned to this polygon.

HSI for Black Capped Chickadee was .5 in riparian habitat. The overstory height which is a component of canopy volume was the factor limiting habitat quality.

An HSI of .4 was calculated for Dabbling Duck in riparian habitat. None of the variables were at or near optimum. The most limiting variables were emergent cover and cover of submerged plants. A value of .1 was assigned to one wetland based on sampling of a similar WDFW polygon.

Fazio Parcel B, located at the northern end of the study area is bounded on the East by Lake River and the Columbia on the West. Total HUs for the parcel are summarized in Table 6. The property contains the majority of Round Lake and associated wetlands, a small portion of Post Office Lake, a feedlot, and an exposed sand area West of Lower River Road.

Western Meadowlark HSI was 1.0 and .9 in two different pasture sites within the parcel. The distance to perch site was limiting in one of the pastures.

HSI for breeding goose was .4 in pasture, .2 in agricultural, .2 in riparian forest and riparian shrub, and .3 and .4 in two different wetland areas. The nature of the available nesting areas were limiting in agricultural and pasture and the condition of the area for brood rearing in agricultural habitat were limiting habitat quality. Riparian sites were evaluated as nest sites only, thus the suitability index for nesting areas was used as the HSI value. Human disturbance, although presumed to differ between the two wetland polygons, was limiting as was the availability of nest sites.

The HSI values for wintering goose were .9 and .6 in pasture and agricultural types respectively. The same factors were limiting as in parcel A.

TABLE 6

EXISTING HABITAT UNIT VALUES BY HABITAT TYPE

Ownership: FAZIO PARCEL B/Round lake area

Habitat Type/Acreage:	**Pasture** (78 acres)	**Agricultural** (101 acres)	**Riparian Forest** (21 acres)	**Emergent Wetland** (24 acres)	**Riparian Shrubland** (10 acres)	**Exposed** (26 acres)	**Urban** (4 acres)	**Total** (264 acres)
Species Model:	**HU's**	**HU's**	**HU's**	**HU's**	**HU's**	**HU's**	**HU's**	**Total HU's**
Mink	0.00	0.00	15.60	2.40	6.20	0.00	0.00	24.20
Western Meadowlark	75.52	0.00	0.00	0.00	0.00	0.00	0.00	75.52
Yellow Warbler	0.00	0.00	14.70	1.80	4.90	0.00	0.00	21.40
Black Capped Chickadee	0.00	0.00	20.40	0.00	0.00	0.00	0.00	20.40
Heron	31.20	0.00	0.00	16.80	0.00	0.00	0.00	48.00
Canada Goose (breeding)	32.44	20.20	3.40	9.00	2.00	0.00	0.00	67.04
Canada Goose (winter)	70.20	60.60	0.00	0.00	0.00	0.00	0.00	130.80
Mallard	15.29	0.00	0.00	0.00	5.70	0.00	0.00	20.99
Dabbling Duck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

HSI values for mallard were .2 in pasture and .7 in one of two riparian shrub polygons. The value of the second polygon was presumed to be zero due to disturbance and other factors. As was typical throughout the study area height of residual cover and cattle grazing disturbance were limiting mallard habitat quality. Although caused by other factors, the same variables were limiting habitat condition in riparian shrub habitat.

Heron HSI in pasture habitat was .4. Values of .4 and .8 were calculated for wetlands on the site. Proximity to potential nest sites and wetland forage quality, were limiting factors for herons on the site. Riparian forest on the site was not deemed suitable for heron nesting although if protected may develop into a potential site in the future.

The HSI for mink was .1 in riparian habitat and ranged from .3 to 1.0 in riparian forest and shrub. Emergent and shoreline cover, as well as cover within 100 meters of water were important factors limiting habitat quality for mink.

A general lack of shrub cover in wetlands resulted in HSI values of zero and .1 for yellow warbler. Values ranging from .4 to .8 were calculated for Riparian habitats. Shrub canopy cover and/or percent hydrophytic shrubs were key limiting factors.

Black capped chickadee HSI ranged from zero in riparian shrub to .9 and 1.0 in riparian forest. The shrub areas were primarily lacking snags which serve as nest sites. The forest stands on this parcel were generally excellent chickadee habitat.

Dabbling Duck values were zero for the two wetlands sampled. This was caused by the complete lack of emergent and submerged vegetation in these waterbodies. However the water depth and gently sloping banks provide tremendous potential for rehabilitation.

WDFW PROPERTIES:

The WDFW lands within the study area are commonly referred to as the Shillapoo and Vancouver Lake Wildlife Areas. These lands are situated in three non-contiguous blocks. Each block will be treated separately in this discussion. The first two blocks make up the Shillapoo Wildlife Area and the third is the Vancouver Lake Wildlife Area. The two wildlife areas are dramatically different in their habitat composition, wildlife values, and management.

Field sampling took place in many of the WDFW wetland, riparian, deciduous forest and pasture areas. Direct sampling of agricultural habitats on WDFW lands did not take place as they were presumed identical to private lands during the growing season. Separate HSI calculations were done for wintering canada

geese based on the existing crop percentages and management types on WDFW land. HSI values for other polygons that were not sampled were derived from field sampling of WDFW or privately owned polygons that were contiguous and/or were presumed to be similar.

The first block is by far the largest portion of the Shillapoo area. It is generally located between State Route 501 and Lower River Road and includes the southern end of the Shillapoo Lakebed. A small portion of the area lies between Lower River Road and a back water of the Columbia River. Total Habitat Units for this evaluation parcel are summarized in Table 7. The unit is comprised largely of open pastures and agricultural lands interspersed with blackberry thickets, brushy fence rows, and riparian and wetland areas.

HSI for meadowlark was .1 in agricultural fields in alfalfa and zero and 1.0 in two different pasture units. The percent of canopy made up of grass was limiting in alfalfa. Herbaceous canopy height (too tall) and distance to perch site were limiting habitat value in the pasture unit receiving the zero value.

Breeding goose HSI was .2 in one riparian area, .2 in agricultural, .1 and .3 in pasture and ranged from zero to .4 in the wetlands sampled. The lack of secure nesting areas is the key limiting factor for breeding geese on WDFW land and throughout the whole study area. One of the pasture units was not suitable for brood use during the study due to tall vegetation height.

Wintering goose HSI was .8 in agricultural and .9 in pasture habitat. The variation in agricultural habitat values on WDFW lands as compared to private lands is due to: 1) the high percentage of cropland that was in alfalfa and 2) the sharecrop management practices on WDFW lands. The high value for pasture is not truly indicative of improvements that could be made for geese through pasture improvement.

HSI for mallard was .2 in pasture habitat. Cattle grazing disturbance was the most important factor limiting habitat value. A mallard HSI of .2 was assigned to two wetlands that were more appropriate to evaluate as nesting cover than brood rearing or feeding habitat. Other wetlands were assigned values for dabbling duck. These wetlands which are essentially dry throughout the nesting season were similar to pasture in that height of residual cover is the most limiting factor along with grazing disturbance.

Heron HSI's were assigned to the following five habitat types: forested wetland (1.0), emergent wetland (.3--1.0), riparian forest (1.0), pasture (.4--.5), Agricultural (.2 in alfalfa only). The forested wetland is the site of the large heron

TABLE 7

EXISTING HABITAT UNIT VALUES BY HABITAT TYPE

Ownership: WDFW/Shillapoo

Habitat Type/Acreage:	**Pasture** (435 acres)	**Agricultural** (344 acres)	**Riparian Forest** (94 acres)	**Emergent Wetland** (93 acres)	**Wetland Forest** (41 acres)	**Dense Decidious** (11 acres)	**Urban** (1 acre)	**Total** (1019 acres)
Species Model:	**HU's**	**HU's**	**HU's**	**HU's**	**HU's**	**HU's**	**HU's**	**Total HU's**
Mink	0.00	0.00	54.28	16.75	14.76	0.00	0.00	85.79
Western Meadowlark	222.00	10.70	0.00	0.00	0.00	0.00	0.00	232.70
Yellow Warbler	0.00	0.00	43.98	11.73	21.73	0.00	0.00	77.44
Black Capped Chickadee	0.00	0.00	0.00	0.00	0.00	8.25	0.00	8.25
Heron	105.18	21.40	90.35	53.90	41.00	0.00	0.00	311.83
Canada Goose (breeding	87.90	68.80	14.60	16.17	0.00	0.00	0.00	188.00
Canada Goose (winter)	380.40	275.20	0.00	0.00	0.00	0.00	0.00	655.60
Mallard	75.90	0.00	0.00	4.20	0.00	0.00	0.00	80.10
Dabbling Duck	0.00	0.00	11.00	21.20	14.35	0.00	0.00	46.55

rookery and had all habitat variables present. Emergent wetlands varied primarily due to differences in forage quality and human disturbance levels. All variables were at or very near optimum levels in the bulk of the riparian habitat along Buckmire and Mathews Sloughs. Average distance to potential nest sites was limiting the quality of pastures as feeding habitat. Alfalfa fields were assigned values as for wet pasture due to observed high use of the areas particularly after harvest.

Mink HSI was .6 in riparian forest, .4 in forested wetland, and ranged from .1 to .3 in emergent wetlands. Limiting factors varied between polygons and included shoreline and emergent cover, cover within 100 meters, and percent of year with water.

HSI's for yellow warbler were .5 in riparian forest and forested wetland, and ranged from zero to .5 in emergent wetlands. As with most other sites evaluated as potential warbler habitat, low percent cover of shrubs, or hydrophytic shrubs in particular, was limiting habitat value.

An HSI of .75 was calculated for chickadee in deciduous forest habitat. Percent tree canopy cover was the limiting factor. Snags within the models suitable size range of 4 to 10 inches dbh were not found in study plots within forested wetland and riparian habitat.

HSI values of .4 in forested wetland, .1 in riparian forest, and a range from .1 to .5 in emergent wetland were calculated for dabbling duck. Emergent cover, submerged aquatic plant cover and in some cases water depth were limiting habitat quality. The placement of islands or artificial nest structures in these wetlands would be necessary to achieve optimum values for dabbling duck habitat quality.

The small second block of WDFW land that is considered part of the Shillapoo Wildlife Area, commonly referred to as Chapman Island, is a recent addition to the Shillapoo Wildlife Area. It is located in the center of the lakebed and historically was an island or the end of a peninsula extending out into the center of the lake. It consists primarily of unimproved pasture habitat that is bisected by a narrow band of riparian forest. Values for riparian forest were derived from sampling on the adjoining Fazio ownership. This parcel was still in private ownership during field sampling. Total habitat units for this parcel are summarized in Table 8.

An HSI of .5 was calculated in pasture habitat for meadowlark. The herbaceous canopy, comprised primarily of reed canary grass, was too tall for use by meadowlark.

Breeding goose HSI was .3 in pasture habitat due to the lack of secure nest sites and the tall condition of the pasture stand.

TABLE 8

EXISTING HABITAT UNIT VALUES BY HABITAT TYPE

Ownership: WDFW/Chapman Island

Habitat Type/Acreage:	**Pasture** (55 acres)	**Riparian Forest** (9 acres)	**Total** (64 acres)
Species Model:	**HU's**	**HU's**	**Total HU's**
Mink	0.00	5.40	5.40
Western Meadowlark	27.50	0.00	27.50
Yellow Warbler	0.00	4.50	4.50
Black Capped Chickadee	0.00	4.05	4.05
Heron	27.50	0.00	27.50
Canada Goose (breeding	16.50	0.00	16.50
Canada Goose (winter)	49.50	0.00	49.50
Mallard	11.00	0.00	11.00
Dabbling Duck	0.00	3.60	3.60

The wintering goose HSI value was .9. We assumed that the pasture would be in a short enough condition by winter for use by canada geese due to ongoing grazing at the time of the survey.

Mallard HSI was .2 in pasture habitat. Human disturbance (grazing) was considered the most limiting factor. Height of residual cover (10 inches) was also limiting but was in a better condition for mallard than most of the pastures in the study area.

HSI values for heron were .5 in pasture and zero in riparian forest which currently is not useable for herons. The pasture received almost the maximum possible value for this habitat type. The limiting factor was the distance to a potential nest site.

HSI for mink was .6 in riparian habitat. All variables relating to cover were limiting. Shoreline cover was at higher levels than most other polygons sampled. Cover within 100 meters of the shoreline and emergent cover were the most limiting variables.

Hydrophytic shrubs were lacking in riparian habitat and total shrub cover was only 36%. This resulted in an HSI for yellow warbler of .5.

Black capped chickadee HSI was .5 in the riparian habitat. The limiting variable was overstory height. The overstory varies throughout the polygon and trees are absent in some areas.

An HSI for dabbling duck of .4 was assigned for riparian habitat. Low levels of emergent cover and submerged vegetation were limiting habitat quality in this polygon.

The Vancouver Lake area is unique compared to the other two WDFW parcels due to the high percentage of wetland habitat. Willow dominated forested wetlands are the most prevalent habitat type. Grazing currently does not take place here. This has created grass and shrubland habitat that has habitat values for some species that are low in much of the remaining study area. Sharecrop farming takes place on a small portion of the area. Total habitat units for the Vancouver Lake Wildlife area site are summarized in Table 9. Most of the emergent wetlands on this site were not sampled because of their similarity to other sampled wetlands.

No habitat units for western meadowlark were calculated for this ownership. This was due to the herbaceous canopy height component being too tall in grass and shrub habitats for use by meadowlark.

Low HSI values were found for breeding goose in pasture (.4), agricultural (.2), and emergent wetland (.4 to .5). Nesting opportunities for this species were limited here as well.

TABLE 9

EXISTING HABITAT UNIT VALUES BY HABITAT TYPE

Ownership: WDFW/Vancouver lake

Habitat Type/Acreage:	**Pasture** (15 acres)	**Agricultural** (44 acres)	**Wetland Forest** (244 acres)	**Emergent Wetland** (47 acres)	**Shrub/Grassland** (110 acres)	**Dense Decidious** (7 acres)	**Urban** (2 acres)	**Total** (469 acres)
Species Model:	**HU's**	**HU's**	**HU's**	**HU's**	**HU's**	**HU's**	**HU's**	**Total HU's**
Mink	0.00	0.00	36.60	10.80	0.00	0.00	0.00	47.40
Western Meadowlark	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yellow Warbler	0.00	0.00	244.00	7.20	0.00	0.00	0.00	251.20
Black Capped Chickadee	0.00	0.00	183.00	0.00	0.00	0.00	0.00	183.00
Heron	7.50	0.00	0.00	23.50	0.00	7.00	0.00	38.00
Canada Goose (breeding)	5.40	8.80	0.00	19.90	0.00	0.00	0.00	34.10
Canada Goose (winter)	15.00	13.20	0.00	0.00	0.00	0.00	0.00	28.20
Mallard	15.00	0.00	0.00	0.00	90.20	0.00	0.00	105.20
Dabbling Duck	0.00	0.00	109.80	17.20	0.00	0.00	0.00	127.00

Wintering goose HSI values were 1.0 in pasture and .3 in agricultural habitat. The agricultural field was in a small grain crop during the study. The small pasture acreage that had been managed in similar fashion to a private adjoining pasture was one of the few in the study area that we felt warranted an "improved" designation.

Mallard HSI values were high in pasture (1.0) and grass/shrub habitat (.8). The high value for pasture was unusual and was due to two factors. The residual height of nesting vegetation was taller than in most areas and grazing pressure was light enough that we considered human disturbance to be low at this site. Nesting vegetation height in shrubland habitat was too tall and herbaceous canopy cover was below optimum levels, possibly due to lodged canary grass acting as a barrier to new vegetation growth.

Heron HSI values were 1.0 in deciduous forest and .5 in pasture and emergent wetland feeding habitat. The small forest stands are currently suitable for use by herons and are near an existing rookery. Human disturbance to the pasture site was low making this an "optimum" pasture. Due to early dry up of the wetlands a "wet pasture" designation seemed appropriate.

Mink habitat values were generally low (.1 to .3) due to the small percentage of the year that most of the wetlands have surface water present. Variables relating to cover were at or near optimum levels in forested wetland.

Emergent wetlands on this site as in other areas were poor yellow warbler habitat due to an absence of shrubs. However, the forested wetlands on the site were excellent warbler habitat. All variables were at optimum resulting in an HSI value of 1.0.

Forested wetlands were also good chickadee habitat. HSI values were .8. Canopy volume represented by a combination of overstory canopy cover and overstory height was limiting habitat value. Deciduous forest stands were lacking snags and thus, received HSI values of zero.

Dabbling duck HSI values were .5 in forested wetlands where water depth and cover of submerged plants limited habitat value. Emergent cover was beyond optimum levels do to the dense woody overstory and was considered too high for this species. One sampled wetland lying within the pasture area received a value of 1.0 for dabbling duck. However, we reduced HU's for this polygon based on the very small period of time that the polygon is usable for ducks as breeding and feeding habitat. Other wetlands were assigned a dabbling duck value of .4 based on their similarity to a sample site within the Shillapoo ownership.

NON-SAMPLED OWNERSHIPS:

The following ownerships were not sampled in the field. Instead, casual observations were made to determine which sampled polygons could be used to represent their habitat values. These observations were made in the field, and from aerial photographs. We feel confident that the habitat units presented in the tables are accurate. However, brief field verification of specific habitat parameters may be warranted on a site by site basis prior to implementation of any projects planned for these areas.

These sites were considered lower priorities for field sampling due to the trends in BPA and WDFW acquisition and planning, and in some cases, the political and social realities of their probable future uses.

Because site specific information was not collected our discussion of these ownerships will be brief.

RUFENER PROPERTY:

The Rufener property lies just south of the Vancouver Lake Wildlife area and includes the southern end of Mulligan Slough. With one exception surface water is only present for a very short period of time each year. This grazed wetland and intermingled pasture make up slightly more than on half of the parcel. The bulk of the remaining acreage is upland agricultural which is primarily in permanent hay type crops. A small heron rookery is present on the parcel. Total habitat units for the parcel are summarized in Table 10.

We calculated a separate Wintering goose value for this property based on the crop type which we considered improved pasture. the Resulting HSI value was 1.0. We also felt that the current management of the hay crop areas would provide good mallard nesting cover similar to the pasture area discussed for the WDFW Vancouver Lake area. Other habitat values were presumed to be similar to those found on the Vancouver Lake area as well.

PORT OF VANCOUVER PROPERTY:

The Port of Vancouver ownership is extensive. For purposes of this evaluation we only applied habitat values to the area lying north of the Vancouver Lake flushing channel. The evaluated area is bounded by SR 501 on the East, the Columbia River to the West, and WDFW land to the North. The site is among the most disturbed in the study area. The natural landscape here has, for the most part, been covered with dredge spoils from the Vancouver Lake restoration project. Most of the area is cultivated or grazed although industrial and recreation developments are planned for the area. By the time this report is finalized sale of the Columbia waterfront in this ownership to Clark County will

TABLE 10

EXISTING HABITAT UNIT VALUES BY HABITAT TYPE

Ownership: RUFENER

Habitat Type/Acreage:	**Pasture** (108 acres)	**Agricultural** (109 acres)	**Forested Wetland** (1 acre)	**Emergent Wetland** (46 acres)	**Dense Decidious** (2 acres)	**Total** (271 acres)
Species Model:	**HU's**	**HU's**	**HU's**	**HU's**	**HU's**	**Total HU's**
Mink	0.00	0.00	0.15	0.00	0.00	0.15
Western Meadowlark	0.00	0.00	0.00	0.00	0.00	0.00
Yellow Warbler	0.00	0.00	1.00	0.00	0.00	1.00
Black Capped Chickadee	0.00	0.00	0.75	0.00	0.00	0.75
Heron	54.00	54.50	0.00	23.00	2.00	133.50
Canada Goose (breeding	38.88	39.24	0.00	20.70	0.00	98.82
Canada Goose (winter)	108.00	109.00	0.00	0.00	0.00	217.00
Mallard	108.00	109.00	0.00	0.00	0.00	217.00
Dabbling Duck	0.00	0.00	0.45	11.50	0.00	11.95

TABLE 11

EXISTING HABITAT UNIT VALUES BY HABITAT TYPE

Ownership: PORT OF VANCOUVER/North of Flushing Channel

Habitat Type/Acreage:	**Pasture** (144 acres)	**Agricultural** (363 acres)	**Riparian Shrubland** (12 acres)	**Wetland Forest** (11 acres)	**Riparian Forest** (36 acres)	**Exposed** (61 acres)	**Urban** (12 acres)	**Total** (639 acres)
Species Model:	**HU's**	**HU's**	**HU's**	**HU's**	**HU's**	**HU's**	**HU's**	**Total HU's**
Mink	0.00	0.00	10.50	3.96	23.04	0.00	0.00	37.50
Western Meadowlark	144.00	18.15	0.00	0.00	0.00	0.00	0.00	162.15
Yellow Warbler	0.00	0.00	6.72	5.83	16.20	0.00	0.00	28.75
Black Capped Chickadee	0.00	0.00	6.00	0.00	0.00	0.00	0.00	6.00
Heron	12.96	36.30	2.04	11.00	34.20	0.00	0.00	96.50
Canada Goose (breeding	43.20	72.60	0.00	0.00	7.20	0.00	0.00	123.00
Canada Goose (winter)	122.40	145.20	0.00	0.00	0.00	0.00	0.00	267.60
Mallard	21.60	0.00	1.20	0.00	0.00	0.00	0.00	22.80
Dabbling Duck	0.00	0.00	0.00	3.85	3.96	0.00	0.00	7.81

probably have been finalized. Part of the Port Comprehensive plan calls for approximately 112 acres of riparian and agricultural habitat to be sold to a resource agency (presumed to be WDFW). Two bald eagle nests (within the same territory) are located within this parcel.

Habitat values for this ownership were derived from polygons that were contiguous or similar to WDFW and private sites to the north. Total habitat units for this parcel are summarized in Table 11.

CLARK COUNTY PARKS OWNERSHIPS:

Clark County's ownership was divided into three distinct units: Frenchman's bar, Vancouver Lake Park, and South Vancouver Lake. Estimated total habitat units for the three units are summarized in Tables 12, 13, and 14. Habitat values were derived from field measurements taken in adjoining or similar habitat polygons on other ownerships.

Frenchman's Bar lies adjacent to WDFW's Shillapoo Wildlife Area and the Columbia River. A portion of the property will soon be developed for intensive human recreation. Plans call for a large portion of the property to remain in open space/wildlife habitat. Currently the parcel consists primarily of exposed sand beach, pasture, and a significant stand of riparian forest habitat along the Columbia River.

The central portion of Vancouver Lake Park is the only area where development for intensive recreation has occurred to date. Although the developed area probably receives incidental use by the indicator species no habitat units were assigned to the area due to high disturbance. The bulk of the remaining portion of this park consists of relatively undisturbed riparian and forested wetland habitat with some agricultural and emergent wetland. The undeveloped northern and southernmost portions of the park are extensions of the unique riparian and forested wetland habitats found in Egger parcel B and the Vancouver Lake Wildlife area discussed above.

The third parcel, South Vancouver Lake, was purchased by the county to maintain an example of a working farm near the growing city. Wildlife habitat concerns are expected to play a large part in the development of a long term plan for the area. This site, like the Port of Vancouver property, was used to deposit dredge spoils from the Vancouver Lake restoration project. Sharecrop farming is planned for the upcoming growing season. WDFW estimates that habitat values for the agricultural habitat, which make up the bulk of the area, are similar to those present on most of the Egger agricultural land. However, we cannot project what the future crops may be. Wetland values were based on WDFW sample sites.

TABLE 12

EXISTING HABITAT UNIT VALUES BY HABITAT TYPE

Ownership: CLARK COUNTY PARKS/Frenchman's bar

Habitat Type/Acreage:	**Pasture** (82 acres)	**Emergent Wetland** (1 acre)	**Riparian Forest** (40 acres)	**Exposed** (24 acres)	**Total** (147 acres)
Species Model:	**HU's**	**HU's**	**HU's**	**HU's**	**Total HU's**
Mink	0.00	0.05	24.00	0.00	24.05
Western Meadowlark	21.40	0.00	0.00	0.00	21.40
Yellow Warbler	0.00	0.00	32.00	0.00	32.00
Black Capped Chickadee	0.00	0.00	36.00	0.00	36.00
Heron	7.38	0.25	0.00	0.00	7.63
Canada Goose (breeding	24.60	0.17	8.00	0.00	32.77
Canada Goose (winter)	69.70	0.00	0.00	0.00	69.70
Mallard	12.30	0.15	0.00	0.00	12.45
Dabbling Duck	0.00	0.00	0.00	0.00	0.00

TABLE 13

EXISTING HABITAT UNIT VALUES BY HABITAT TYPE

Ownership: CLARK COUNTY PARKS/Vancouver lake park

Habitat Type/Acreage:	**Wetland Forest** (155 acres)	**Agricultural** (40 acres)	**Riparian Forest** (73 acres)	**Emergent Wetland** (7 acres)	**Urban** (45 acres)	**Total** (320 acres)
Species Model:	**HU's**	**HU's**	**HU's**	**HU's**	**HU's**	**Total HU's**
Mink	23.25	0.00	73.00	0.00	0.00	96.25
Western Meadowlark	0.00	28.00	0.00	0.00	0.00	28.00
Yellow Warbler	155.00	0.00	51.10	0.00	0.00	206.10
Black Capped Chickadee	116.25	0.00	73.00	0.00	0.00	189.25
Heron	0.00	16.00	73.00	0.00	0.00	89.00
Canada Goose (breeding	0.00	8.00	0.00	1.40	0.00	9.40
Canada Goose (winter)	0.00	36.00	0.00	0.00	0.00	36.00
Mallard	0.00	32.00	0.00	7.00	0.00	39.00
Dabbling Duck	69.75	0.00	0.00	0.00	0.00	69.75

TABLE 14

EXISTING HABITAT UNIT VALUES BY HABITAT TYPE

Ownership: CLARK COUNTY PARKS/South Vancouver lake

Habitat Type/Acreage:	**Agricultural** (274 acres)	**Emergent Wetland** (11 acres)	**Total** (285 acres)
Species Model:	**HU's**	**HU's**	**Total HU's**
Mink	0.00	3.63	3.63
Western Meadowlark	0.00	0.00	0.00
Yellow Warbler	0.00	2.31	2.31
Black Capped Chickadee	0.00	0.00	0.00
Heron	0.00	5.50	5.50
Canada Goose (breeding	54.80	3.85	58.65
Canada Goose (winter)	137.00	0.00	137.00
Mallard	0.00	0.00	0.00
Dabbling Duck	0.00	4.18	4.18

CITY OF VANCOUVER PROPERTY:

The City of Vancouver land is a continuation of the agricultural habitat and management philosophy discussed for Clark County's South Vancouver Lake site above. Estimated total habitat units for this parcel are summarized in Table 15. In addition to agricultural land this parcel contains the only example of lowland oak forest in the study area. Although we used a sample site from the nearby Vancouver Lake Wildlife Area to assign habitat values to the stand, the site may actually have higher values and warrants further study if WDFW and BPA pursue cooperative agreements for the area.

DISCUSSION:

Management of agricultural and grazing programs will probably always remain among the key strategies for this area. However, this evaluation has suggested many other areas that should receive both immediate and long term attention. These other management objectives should be balanced with wintering waterfowl, public recreation and other concerns.

Existing wetland and riparian habitats should be rehabilitated back to a more native condition wherever possible. Long term maintenance will be necessary to achieve maximum wetland habitat values. Reestablishment of these habitat types should be a high long term priority. Developments toward this goal could begin immediately. Increased diversity of wildlife use, habitat interspersion, and recreational opportunities would result.

Agricultural management for canada geese should continue in the short term. High output of agricultural foods, for waterfowl, is currently very important in this region. However, moist soil wetland management techniques may show promise in increasing the value of some agricultural lands, to geese, in a more natural wetland environment. In addition to improving goose habitat, habitat unit gains for other species would result from moist soil management as well. This type of development is not necessarily less intensive in terms of active management. Control of water levels and related vegetation manipulation may be almost as demanding as active agriculture to achieve the desired result.

An ongoing program to monitor human use impacts should be established. The program should emphasize sensitive and potential heron and eagle breeding sites, wintering waterfowl populations, and aquatic and wetland habitats.

Acquisition or habitat protection strategy is not a simple question to address. Any strategy must also consider the practicalities of management, the socio-economic environment, and the long-term management potential of each parcel. Based on this evaluation many of the most unique habitat features of the

TABLE 15

EXISTING HABITAT UNIT VALUES BY HABITAT TYPE

Ownership: CITY OF VANCOUVER/South Vancouver lake

Habitat Type/Acreage:	**Agricultural** 123 acres	**Oak** (7 acres)	**Total**
Species Model:	**HU's**	**HU's**	**Total HU's**
Mink	0.00	0.00	0.00
Western Meadowlark	0.00	0.00	0.00
Yellow Warbler	0.00	0.00	0.00
Black Capped Chickadee	0.00	0.00	0.00
Heron	0.00	7.00	7.00
Canada Goose (breeding	24.60	0.00	24.60
Canada Goose (winter)	61.50	0.00	61.50
Mallard	0.00	0.00	0.00
Dabbling Duck	0.00	0.00	0.00

project area have already been protected through WDFW, Clark County and City of Vancouver programs. The listing below is a proposed prioritized listing of potential acquisitions in this project area. The listing is based primarily on current value and the perceived site potential. Social and economic factors such as other agencies mandates, and perceived public sentiment have also been considered.

A	Herzog property
B	Egger parcel A
C	Fazio parcel A
D	Rufener property
E	Fazio parcel B
F	Egger parcel B
G	Port of Vancouver Property

The three lakebed parcels (priorities A,B,C) are considered most important due to their long-term management potential. The Rufener property and Fazio parcel B both have high current values for the more unique habitat types in the area and have tremendous wetland restoration potential. Egger parcel B has both unique habitat values and good potential for restoration. The Port of Vancouver property is listed last even though it contains sensitive wildlife sites, and has tremendous potential for wintering waterfowl management. This is due to the current habitat condition caused by past disturbance (filling) and ongoing public debate over whether or not the site should be developed for industrial and other uses.

It is recognized that all or part of any of the above parcels (A through G) may be acquired at any given time depending on funding and other factors. Should only part of one of the parcels be acquired, the remaining portion should be evaluated and the above priorities revisited. Because funding is not currently available for protection of all of the properties, partnership opportunities should be explored.

CONCLUSION:

The Vancouver Lowlands area is biologically important to many wildlife species. Although protection of existing habitat values is a top priority, the potential for habitat enhancement is tremendous.

Programs for enhancement, following acquisition, should be evaluated to estimate the potential benefits to target/non-target wildlife species and priority habitats. Subsequent habitat evaluations, and monitoring wildlife response to habitat manipulations, may prove useful in evaluating mitigation success and the need to modify, through adaptive management, enhancement techniques.